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Shoulder stabilization by modified Latarjet-Patte procedure: Results at a minimum 10 years' follow-up, and role in the prevention of osteoarthritis



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ABSTRACT

Introduction: In 1995, our team modified the Latarjet-Patte procedure by associating “south-north” capsule retention with reinsertion to the edge of the glenoid cavity to the coracoid bone-block.

Hypothesis: The present minimum 10-year follow-up study tested the hypothesis that the rate of osteoarthritis could be reduced by the strictly extra-articular position of the bone-block and stability be enhanced by the associated Bankart effect.

Material and method: Between January 1995 and December 2001, 78 shoulders were stabilized using the modified Latarjet-Patte procedure in 76 patients with a mean age at surgery of 26.7 years; 89.7% could be followed up, 82.8% of whom also had radiographic follow-up. Fifty-nine were sports players, including 25 at competition level. Stability was assessed on a questionnaire, any dislocation or subluxation being counted as recurrence.

Results: At a mean 13 years' follow-up (range, 10–15 years), there had been no revision surgery. Mean Duplay score was 82.6, mean Subjective Shoulder Value 91.9% and the satisfaction rate 98.5%. The recurrence rate was 1.4% and 10 patients reported residual apprehension. The osteoarthritis rate was 8.5%. Seven bone-blocks projected, but only one was associated with osteoarthritis (stage 1) (non-significant). There were 4 non-unions and 9 lyses, without instability or pain.

Discussion: The modified procedure provided a low rate of recurrence and an incidence of osteoarthritis (8.5%) much lower than in any other published series with a minimum 10 years' follow-up. The strictly extra-capsular situation of the bone-block appeared as an important factor in limiting long-term osteoarthritis. Capsule reinsertion also seemed to alleviate the radiologic complications.

Level of evidence: IV, retrospective study.

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1. Introduction

Two techniques are widely applied in the surgical management of recurrent anterior instability of the shoulder: bone-block as described by Latarjet in 1954 [1] and modified by Patte in 1980 [2], and Bankart-type capsular retention or reinsertion, first described in 1938 [3]. Both give good functional results: for the Latarjet-Patte procedure, 92% of patients report satisfaction [4], 76% have good or excellent Duplay scores, and mean WOSI [5] is 87.8%; for Bankart procedures, 82% of patients report satisfaction [6], 79% have good or excellent Duplay scores, and mean WOSI is 79% [7]. Even so, bone-block procedures involve a risk of shoulder osteoarthritis ranging from 22% to 80% depending on the series [4,8–11] and Bankart

techniques involve a fairly high risk of recurrence, ranging from 7.7% to 12% [6].

The bone-block technique is widespread in France, as it was first described there and shows a low rate of recurrence: 1% for Coudane and Walch [4]. Even so, to reduce the risk of osteoarthritis and improve stability, our team modified Patte's technique. Patte introduced the concept of “triple locking”: the direction of the conjoint tendon is modified, giving it a dynamic blocking function against the humeral head in outstretched positions of the upper arm, reinforcing the mechanical effect of the bone-block and the “hammock” effect induced by lowering the subscapularis tendon. Finally, the capsule is sutured to the acromioclavicular ligament. In the modified technique we introduced in 1995, the capsule is reinserted in the edge of the glenoid cavity, as in the Bankart procedure, leaving the bone-block in a strictly extra-articular position while adding a “Bankart effect”. This two-fold modification was intended to enhance stability and reduce osteoarthritic evolution.

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The present study examined whether the modification achieved these twin objectives in the long term.

2. Material and method

The surgical technique was unvarying: on a deltopectoral approach, the coracoid was exposed by disinserting the acromioclavicular ligament and pectoralis minor tendon; the horizontal part of the coracoid was sectioned by osteotome and put aside. The subscapularis fibers were separated up to the junction between the superior two-thirds and inferior third. The entire capsular plane was released from the deep side of the subscapularis; capsulotomy was extended horizontally up to the edge of the glenoid labrum and the capsule was disinserted downward against the bone, creating an inferior capsular flap. Two Ethibon™ sutures were run in a U form through the flap, for “south-north” retention. The labrum was resected where damaged. The anterior face of the glenoid cavity was freshened by osteotome. A screw-hole parallel to the joint line was drilled in the glenoid neck at a distance from the cavity edge at least 1–2 cm greater than the distance between the hole in the coracoid and the lateral edge of the coracoid, so that the bone-block could subsequently be positioned flush with or slightly back from the edge (Fig. 1). The inferior side of the coracoid was freshened with a saw so as to obtain a flat cancellous surface. Two holes were drilled for the two 3.5 mm screws, then three 1.5 mm holes in the lateral side of the bone-block for the two capsule sutures (Fig. 2), to form a transosseous U (Fig. 3). The bone-block was positioned using the superior (compression) screw. Bone-block rotation was adjusted before introducing the second screw (Fig. 4). The Ethibon™ sutures were knotted and the inferior capsular flap stretched upward (Fig. 5), with the arm held in 50° external rotation. This rendered the bone-block extra-articular, without restricting external rotation. The horizontal arthrotomy was closed so as to obtain a capsuloplasty effect in case of hyperlaxity; then the lateral part of the subscapularis tendon was sutured (Fig. 6). Drainage was systematically installed.

Postoperative management was standardized, with 3 weeks’ immobilization ensured by an elbow-to-body device, later replaced by a simple sling. Cautious rehabilitation was initiated in postoperative week 3.

2.1. Population

Between January 1995 and December 2001, 79 patients underwent this modified procedure for recurrent unidirectional anterior instability of the shoulder. Three patients with instability associated with massive rotator cuff tear were excluded, leaving 76 patients (2 bilateral cases: 78 shoulders), for a minimum 10 years’ follow-up; 8 were lost to follow-up; the remaining 68 (48 male, 20 female), for 70 shoulders (63% dominant side), responded to a postal questionnaire. Complete follow-up assessment (questionnaire plus radiography) was possible for 58 shoulders. Mean age at surgery was 26.7 ± 8.4 years. Fifteen patients were aged less than 20 years. Fifty-nine played sports, including 25 at competition level and 35 practicing at-risk sport (volleyball, handball, judo). Forty-three shoulders concerned manual workers, 24 concerned sedentary workers and 3 concerned patients who were not working. Fifteen showed hyperlaxity, defined as > 85° external rotation [4] or positive hyperabduction test [12].

Primary dislocation etiology was identifiably traumatic in 63 shoulders, including 54 sports accidents, as previously reported by Walch [13], with a mean age at trauma of 21.2 ± 6 years (median, 19 years). Recurrence involved true dislocation (57 shoulders; 2 to 30 episodes) or subluxation (12 shoulders); 1 case involved only a single dislocation. None of the shoulders had undergone

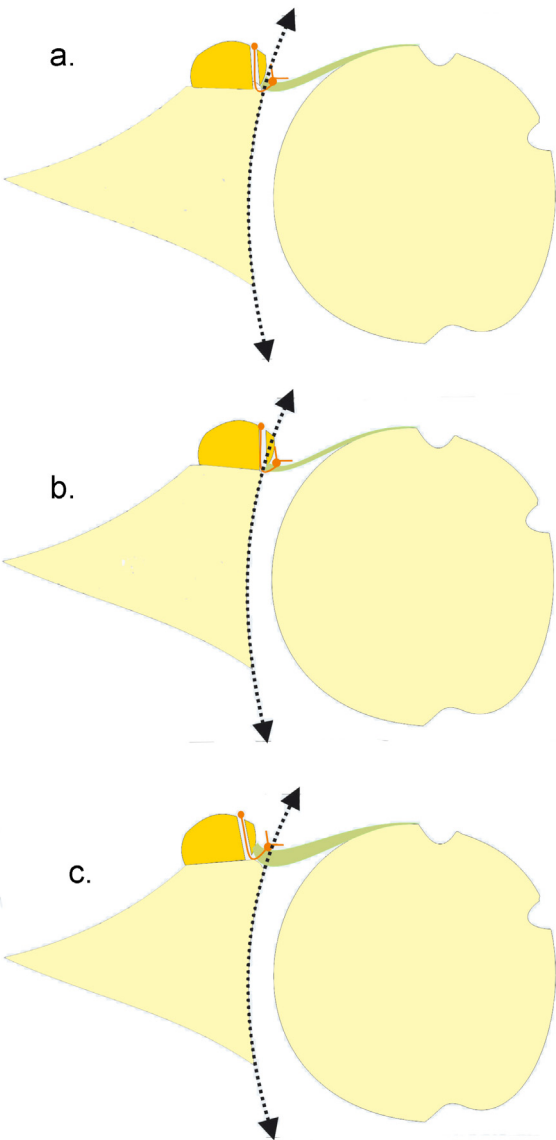


Fig. 1. Bone-block position: a: flush; b: projecting; c: back from edge.

Table 1
Population distribution on preoperative Duplay score.

Duplay score(preoperative)	Population(n = 70)
Excellent (91 to 100)	0
Good (76 to 90)	1
Medium (51 to 75)	10
Poor (≤ 50)	59

stabilization surgery; 10 had undergone arthroscopic exploration. Fourteen involved occasional pain (forced movement) and 1 displayed daily pain. Mean preoperative Duplay score was 48.6 ± 13, with 59 poor scores (< 50 points) (Table 1). ISIS scores [14] were determined retrospectively (Table 2).

Table 2
Relationship between hyperlaxity and apprehension.

	No hyperlaxity	Hyperlaxity	Total
Stable	50	10	60
Apprehension	5	5	10
Total	55	15	70

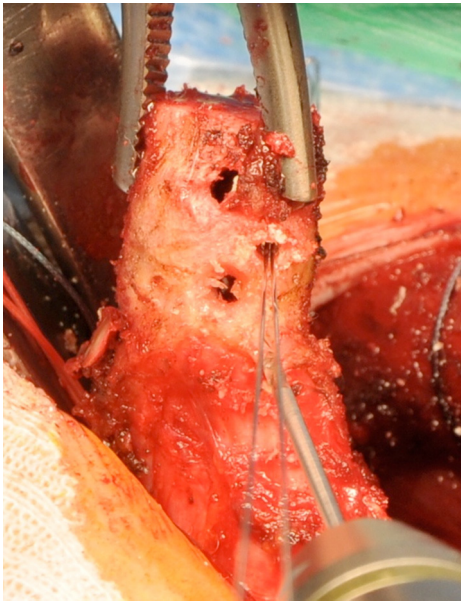


Fig. 2. Bone-block preparation.

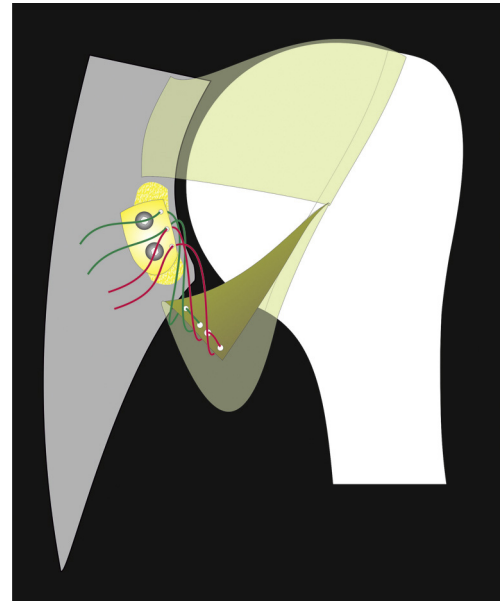


Fig. 4. Suture passage through capsule flap.

There were 30 glenoid fractures on Bernageau lateral view [15] and 40 notches visible on external rotation. Sixty-eight shoulders were free of osteoarthritis; 1 was graded stage I and 1 stage II according to Samilson and Prieto [16]. There was only 1 case of (partial) joint-line impingement.

The 70 surgical procedures were performed by 11 surgeons, 1 of whom performed 51. Surgical technique was uniform; 67 procedures used 2 screws and 3 procedures only 1 screw because of small bone-block; 10 procedures used washers. The one postoperative complication was a case of complex regional pain syndrome; there were no neurological disorders or surgery site infections.

2.2. Follow-up methodology

Follow-up was based on functional questionnaires using diagrams, not requiring face-to-face consultation, assessing range of

motion and functional results, and on plain X-ray. Duplay scores could thus be determined at more than 10 years' follow-up. The WOSI questionnaire [5] was filled out for 26 shoulders.

Clinically, only true dislocation or subluxation was counted as recurrence [4,8]. Apprehension, although not counted as failure, was recorded.

Radiologically, bone-block position was located on AP view, determining its height with respect to the equator of the glenoid cavity. Bernageau lateral views classified bone-block position as projecting flush with or back from the bony edge of the glenoid cavity. Bone-block consolidation was defined by absence of radiolucency between the bone-block and the glenoid neck; non-union was defined by presence of a radiolucent line between the bone-block and the glenoid cavity. Bone-block lysis, defined by the disappearance of the cortical part of the coracoid graft, although difficult to analyze on plain radiographs, was graded as absent, partial

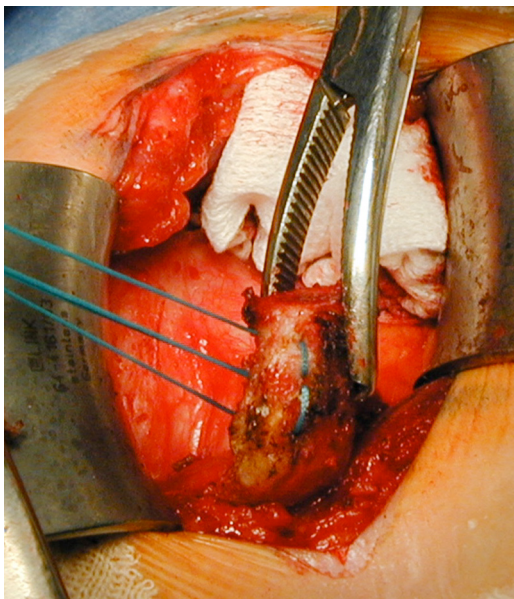


Fig. 3. Transosseous U-suture for capsule reinsertion.

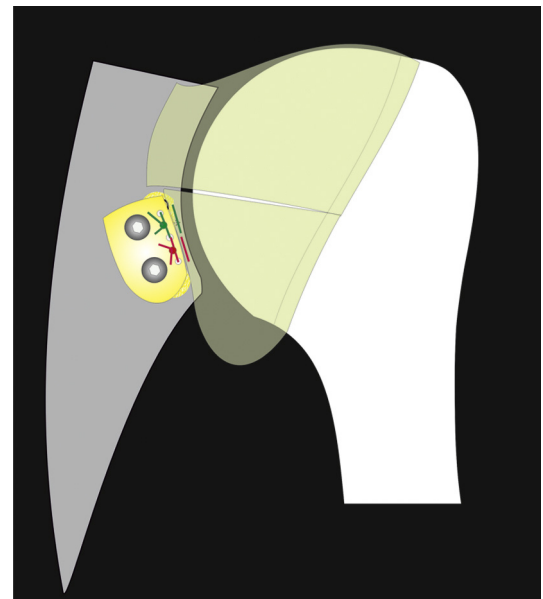


Fig. 5. Capsule reinsertion diagram.

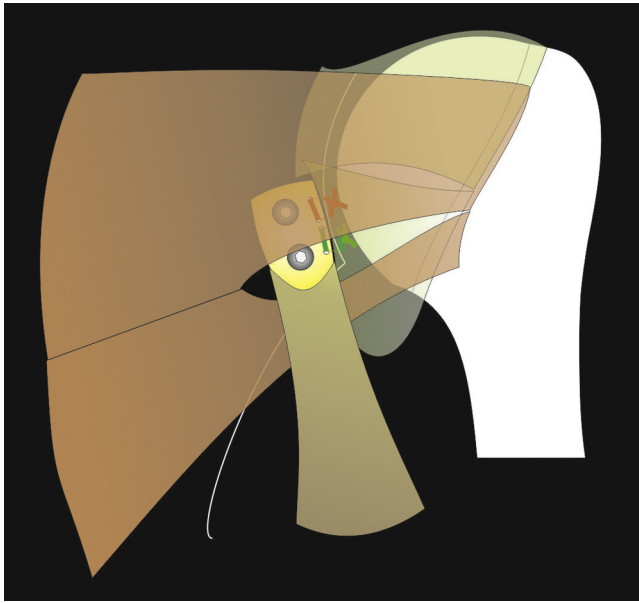


Fig. 6. Bone-block at end of surgery.

or total. Shoulder joint degradation was analyzed on the Samilson-Prieto classification [16] and in terms of joint-line impingement.

2.3. Statistical methodology

Quantitative variables were analyzed on non-parametric Mann-Whitney test and presented as mean (SD). Qualitative variables were analyzed on contingency tables and Fisher exact test. The significance threshold was set at $P < 0.05$. All statistical analyses were performed on StatView 3.0 (Abacus Concepts Inc., Berkeley, CA) and R v.2.10.1 software.

The very low incidence of osteoarthritis of the shoulder precluded statistical processing; analysis of this parameter is purely descriptive.

3. Results

Patients were able to be recontacted for 70 of the 78 shoulders: i.e., a response rate of 89.7%; 58 of these patients had complete data

Table 3

Duplay score, preoperatively and at >10 years' follow-up.

Duplay score	Preoperative	> 10 years' FU
Mean score	48.6 pts (± 13)	82.6 pts (± 15.6)
Median score	50 pts	90 pts
Excellent (91 to 100)	0	15
Good (76 to 90)	1	21
Medium (51 to 75)	10	19
Poor (≤ 50)	59	3

(questionnaire plus X-ray): i.e., 74.3% radiologic follow-up. Mean follow-up was 13 ± 2 years.

A total of 98.5% of patients were satisfied or very satisfied; only 1 was disappointed and none were dissatisfied. Mean Simple Shoulder Value (SSV) was $91.9 \pm 9\%$. The sole case of recurrence was a true dislocation (i.e., 1.4%), following a fall sustained 2 years postoperatively, without associated hyperlaxity or subsequent recurrence or secondary instability at follow-up; SSV was 95%. Ten patients (14%) reported persistent apprehension more than 10 years postoperatively, with a mean SSV of 87.5%. Preoperative hyperlaxity correlated significantly with residual apprehension ($P = 0.0494$) (Table 2). No subluxation was found, even in case of persistent apprehension. There was no significant correlation between ISIS score at end of follow-up and residual apprehension or recurrence ($P = 0.67$).

For 10 of the 70 operated shoulders (14%), patients reported restricted range of motion.

For 23 of the 70 operated shoulders (33%), patients reported pain; pain was occasional in 20 cases and daily in 3. There was no significant correlation between pain and presence of washers ($P = 0.279$), hyperlaxity ($P = 0.2258$) or high-energy dislocating sport accident ($P = 0.3664$).

Mean Duplay score at >10 years was 82.6 ± 15.6 , versus 48.6 ± 13 preoperatively (Table 3). The 3 cases of "poor" Duplay score comprised 1 of recurrent dislocation and 2 of daily pain. Competition sports players had significantly poorer Duplay scores than occasional players ($P = 0.0164$). Eighty-three percent of patients resumed sport, 61% resuming their previous sport activity; 13.5% ceased all sport activity for reasons unconnected to the shoulder.

Mean WOSI score, analyzed for 26 shoulders, was 89.7% (range, 45–100%; median, 93.1%).

There was no revision surgery to the shoulder, for instability or for pain. There was no surgery to remove material.

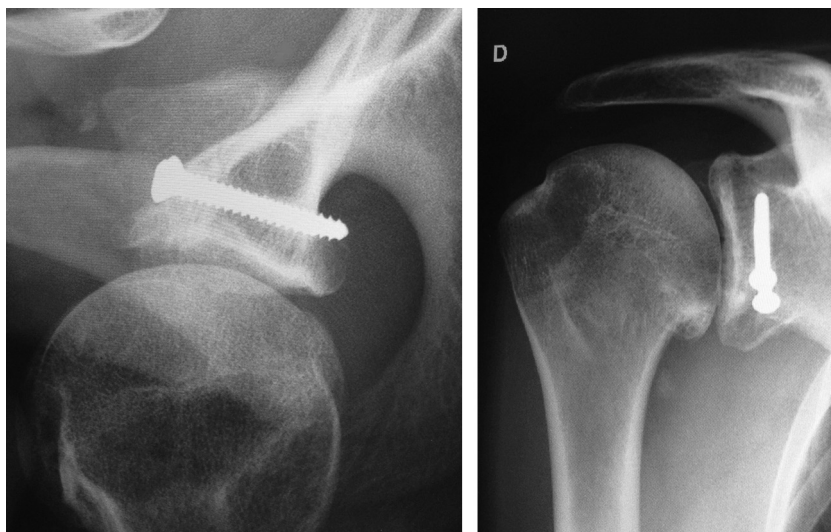


Fig. 7. The Samilson-Prieto stage II patient.

Table 4

Functional results in patients with osteoarthritis of the shoulder.

	Follow-up (yrs)	Duplay	SSV (%)	Satisfaction	Do it again?	Pain (Duplay)	Stability (Duplay)	Daily activity (Duplay)	Mobility (Duplay)
Stage I	15.4	30	50	Satisfied	Yes	0	15	0	15
Stage I	16.8	65	95	Very satisfied	Yes	25	25	0	15
Stage I	13.5	85	85	Satisfied	No	25	25	10	25
Stage I	11.7	100	80	Satisfied	Yes	25	25	25	25
Stage II	11.8	75	90	Very satisfied	Yes	25	25	0	25

Radiological analysis found 3 new cases of Samilson stage-I osteoarthritis of the shoulder (5.2%); added to 2 cases of pre-existing osteoarthritis that remained stable (1 stage I and 1 stage II), this gave an overall osteoarthritis rate of 8.6% (Fig. 7). Two of these 5 cases presented with preoperative glenoid fracture; 1 was already arthritic and the other developed secondary stage I osteoarthritis. The case of preoperative partial joint impingement (the stage II case) worsened, and a second case, preoperatively free of impingement, developed < 50% impingement: i.e., an overall joint impingement rate of 3.4%; neither of these cases was associated with bone-block projection. The functional impact of osteoarthritis was slight (Table 4).

Analysis of bone-block position found only 1 subequatorial bone-block, and no screw migration or dismantling. On Bernageau lateral view, 7 bone-blocks were projecting, without significant correlation with residual pain or onset of osteoarthritis. In only 1 case of projecting bone-block was there stage-I osteoarthritis. There were 9 cases of bone-block lysis (Fig. 8), 7 total and 2 partial, without significant correlation with residual pain ($P=0.7031$) or apprehension. Four bone-blocks showed non-union and 6 migrated, without clinical impact.

4. Discussion

In anteroinferior shoulder instability, surgery addresses two main issues: sustainable stability, which is the main preoccupation of the patient, and conservation of a healthy shoulder over the long term. At a mean 13 years' follow-up with an 89.7% response rate including radiologic follow-up in 74.3% of cases, the present series is one of the very few reports of long-term assessment of the evolution of osteoarthritis and shoulder stabilization by coracoid bone-block.

Patients showed improvement, with a 98.5% satisfaction rate, mean SSV of 91.9%, mean Duplay score of 82.6 points and 94% of patients who would not hesitate to undergo the procedure again. Subjective assessment is, however, extremely difficult to control. The only patient not willing to undergo the procedure again had stage-I osteoarthritis of the shoulder but an SSV of 85%, no apprehension and a Duplay score of 85. The study lacked power to analyze the cases of osteoarthritis of the shoulder at 13 years, but the patients did not seem to be bothered by their condition. The mean WOSI score of 89.7% was comparable to that reported by Hovelius [7] (88%) for his bone-block series, and better than that of Bankart's series (79%).

Return to sport was comparable to Coudane and Walch's [4] rate of 33% resumption at the previous level; in their report, it was clear that the clinical follow-up rate in their population of young patients was low (34%), and we therefore opted for follow-up by radiography and questionnaire, recontacting 89.7% of patients and performing follow-up X-ray in 74.3%, thus obtaining more representative results for the evolution of stability and osteoarthritis.

The study was, however, retrospective and involved certain limitations. There was no clinical follow-up, but only the patients' self-assessment. Rotation could not be measured, and thus no correlation could be analyzed between impaired external rotation and

osteoarthritis. Apprehension was likewise assessed only subjectively, with no clinical apprehension test.

The present 1.4% recurrence rate is comparable to those reported in the literature. Allain [8] found no recurrence, and Coudane and Walch [4] had a rate of 6%; both these were much lower than Bankart's arthroscopic series, with their recurrence rate of about 13% [17]. Hovelius [7] reported 31% recurrence or subluxation on Bankart procedures in a series of 185 over-17-year-olds, and 13% for Bristow-Latarjet bone-block. The rate of apprehension was high in the present series, at 14%, half of which were associated with hyperlaxity; this is to be compared with 10% for Allain [8] and 23% for Coudane and Walch [4]. The "stabilizing" effect of the present "south-north" retention technique was thus not clearly demonstrated. There was a significant correlation between long-term apprehension and hyperlaxity, and patients exhibiting hyperlaxity should doubtless be informed of this risk.

The natural history of unstable shoulder, described by Hovelius [9], evolves toward osteoarthritis in 55% of cases by 25 years, even following only one episode of dislocation. Surgically stabilized shoulders are less liable to develop osteoarthritis in the long term compared to spontaneously stabilizing shoulders. The present results failed to demonstrate significant correlation between predisposing factors [9] (age > 25 years at first dislocation, high-energy trauma, glenoid fracture) and onset of osteoarthritis of the shoulder.

Many studies [4,6,10,11,17,18] have focused on osteoarthritic evolution in coracoid bone-block at more than 10 years' follow-up, reporting rates of 22–62% that are much higher than the present finding of 8.6% at 13 years. Extra-articular bone-block thus seems to protect against osteoarthritis of the shoulder. Allain's series of Latarjet bone-block procedures [8] analyzed the importance of good positioning, while confirming efficacy (zero recurrence); although with a high incidence of osteoarthritis (62%). Projecting bone-block (53% in their series) significantly increased the risk of osteoarthritis, while flush positioning (41%) provided long-term protection. This hypothesis was confirmed by Hovelius [10] in a series of Bristow-Latarjet procedures with 15 years' follow-up: incidence of osteoarthritis was twice as high in projecting (17%) as in well-positioned bone-blocks (8%). Coudane and Walch [4], reporting results at a mean 11.7 years' follow-up, in 52 Latarjet bone-block procedures, found 50% osteoarthritis of the shoulder, with bone-block projection in 33% of these cases, but did not demonstrate a direct correlation with bone-block projection. The present series displayed 12% bone-block projection, including only 1 case of osteoarthritis: i.e., projecting bone-block seldom induced osteoarthritis of the shoulder. The number of cases of osteoarthritis was too small to be able to demonstrate any significant correlation with bone-block projection, but we believe capsule interposition plays a protective role in case of projection.

Capsule management and the intra- or extra-articular position of the bone-block are not consensual. Allain [8] sutured capsules edge-to-edge without retention, thus obtaining an intra-articular bone-block. For Coudane and Walch [4], the acromioclavicular ligament remnant left on the bone-block was sutured to the capsule in 75% of cases, although retention was not reported. Capsule suture to the acromioclavicular ligament remnant does not isolate

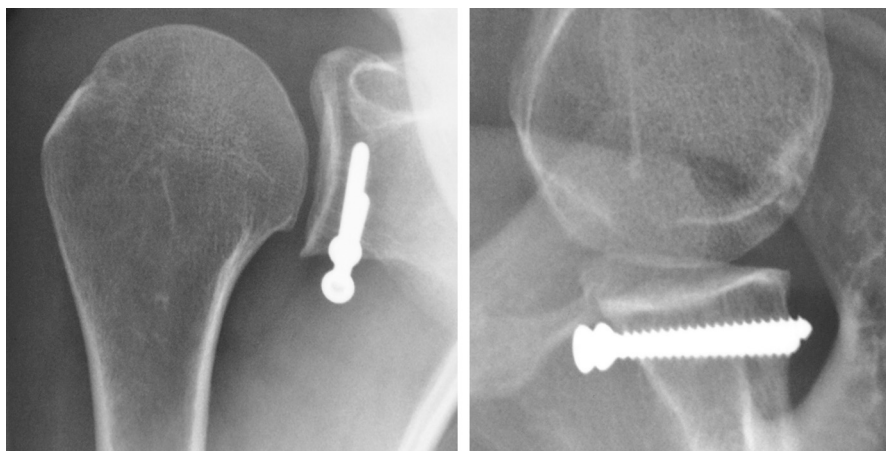


Fig. 8. Complete bone-block lysis.

the bone-block completely, allowing persistent contact with the humeral head, which may be a factor of osteoarthritic evolution. In 2000, Hovelius et al. [19] described an interesting variant of their technique using capsulopexy; there was, however, no radiological follow-up. Excessive “east-west” capsule retention was clearly implicated as a factor of osteoarthritic evolution, impairing external rotation, whether on Putti-Platt [20] or Bankart [21] procedures. To circumvent this pitfall, we perform “south-north” retention with the limb in 50° external rotation, so as to avoid any postoperative restriction.

In the present series, there were very few ($n=3$) new cases of osteoarthritis at more than 10 years’ follow-up compared to previous similar series [4,8,10,11]. The main technical difference would seem to relate to capsule closure, providing an extra-articular bone-block. Although the present results lacked power to demonstrate statistical significance, this technical trick seemed to alleviate the harmful effects of a projecting bone-block and natural evolution toward osteoarthritis of the shoulder. With a 15% rate of bone-block lysis, no functional impact emerged, confirming previous reports [4,6,8] and the absence of significant correlation with residual apprehension. The 17% rate of non-union or migration was likewise without clinical impact on pain, recurrence or residual apprehension, in agreement with previous reports [4,6].

5. Conclusion

The present series confirmed previously reported good results with this open coracoid bone-block procedure in terms of stability and functional outcome. The present vogue for arthroscopic Latarjet techniques should not overshadow the objective of excellent outcome. Previous surgical techniques only slightly limited osteoarthritic evolution or else even worsened it. Given a reliable and reproducible technique, stabilization surgery should aim at reducing the rate of long-term osteoarthritis of the shoulder. The present technique, with an 8.5% rate at 13 years, reduced the risk of onset after stabilization 5-fold, with a very low rate of recurrence (1.4%) and a satisfaction rate of 98.5%. This modification to the historical Latarjet-Patte procedure thus seems to provide real benefit.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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